scaffolds
F R U I T J O U R N A L
Update on Pest Management and Crop Development
May 14, 2007 VOLUME 16, No. 9 Geneva, NY

INSECTS

INSECT AIRWAY

ORCHARD RADAR DIGEST

Geneva Predictions:

Roundheaded Appletree Borer
RAB adult emergence begins: June 2;
Peak emergence: June 16.
RAB egglaying begins: June 11. Peak egglaying period roughly: July 1 to July 15.

Codling Moth
1st generation 3% CM egg hatch: June 13 (= target date for first spray where multiple sprays needed to control 1st generation CM).
1st generation 20% CM egg hatch: June 20 (= target date where one spray needed to control 1st generation codling moth).

Lesser Appleworm
1st LAW flight, 1st trap catch: May 15. Peak trap catch: May 26.

Mullein Plant Bug
Expected 50% egg hatch date: May 19, which is 9 days before rough estimate of Red Delicious petal fall date.
The most accurate time for limb tapping counts, but possibly after MPB damage has occurred, is when 90% of eggs have hatched.
90% egg hatch date: May 25.

Obliquebanded Leafroller
1st generation OBLR flight, first trap catch expected: June 14.

Oriental Fruit Moth
1st OFM flight begins approximately: May 9.
Optimum 1st generation first treatment date, if needed: May 9. Second treatment date, if needed: June 5.

Redbanded Leafroller
Peak trap catch and approximate start of egg hatch: May 9.

San Jose Scale
First adult SJS caught on trap: May 23.

Spotted Tentiform Leafminer
1st STLM flight, peak trap catch: May 15.
1st generation sapfeeding mines start showing: May 26.
Optimum sample date is around May 75, when a larger portion of the mines have become detectable.

White Apple Leafhopper
1st generation WALH found on apple foliage: May 17.
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IN THIS ISSUE...

WEB SEARCH

IN TENTS PRESSURE
(Art Agnello, Entomology, Geneva)

Populations of Eastern and/or tent caterpillar are once again very numerous this spring, particularly in the eastern part of the state, so you should be aware that this insect could show up in your orchard (or adjacent wooded areas) if it isn't there already. Infestations of the eastern species are noticeable as large, thick webs containing many hairy brown caterpillars (with a yellow line down their back) occurring in the forks and crotches of fruit and shade trees during the spring. Forest tent caterpillars do not construct webs, and have a row of elongated spots along their back. Leaves may be completely eaten on all the branches within a few feet of these nests, which can be found on many trees, including wild cherry, apple, peach, plum, and a number of non-fruit trees such as beech, birch, oak, willow and poplar. They can nearly defoliate smaller trees when populations are high.

Physical control of the colonies is possible by removal of the webs and larvae from the tree; remove egg masses when detected while pruning. Localized intervention is recommended on the most severely infested trees. Economic infestations can be controlled by the use of selective (such as B.t.) or broad-spectrum insecticides, although the B.t. option might be preferable at this period of the season for reasons of bee safety.❖❖

WORM BURNERS

DON'T GIVE ME ANY LEP
(Harvey Reissig & Dave Combs, Entomology, Geneva)

❖❖ As a warm-up to the internal worm management process this season, here is a synopsis of a small-plot efficacy trial conducted against codling moth and oriental fruit moth in a Wayne Co. orchard last year.

Treatments were applied by handgun sprayer at 400 psi to 'Golden Delicious' trees in a commercial orchard with a history of internal worm infestation. The Sprays began at petal fall and were reapplied approximately every 14 d. Treatments consisted of either one material season-long, or a combination of materials timed for historic peak flights and emergences. Materials and timings are listed on Table 1. Treatments were replicated 4 times and arranged in a RCB design. Damage from the first generation was assessed by evaluating 100 fruits on the tree on 20 Jul by rating either presence or absence of internal worm damage. Final harvest evaluations were taken on 12 Sep by picking and inspecting 100 fruits/tree and rating them as either

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Dept. of Entomology
NYSAES, Barton Laboratory
P.O. Box 462
Geneva, NY 14456-0462
Phone: 315-787-2341 FAX: 315-787-2326
E-mail: ama4@cornell.edu

Editors: A. Agnello, D. Kain

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Table 1. List of treatments against internal leps in Wayne Co. trial, 2006

Trt	Material	Timing	Rate/ 100 gal	PF	1C	2C	3C	4C	5C	6C	7C
1	Assail 70WP	PF-7C	0.5 oz	5/23	6/7	6/16	7/6	7/20	8/1	8/14	8/31
2	Calypso 4F	PF-7C	1.5 oz	5/23	6/7	6/16	7/6	7/20	n/a*	8/14	8/31
3	Warrior 1CS	PF-7C	1.5 oz	5/23	6/7	6/16	7/6	7/20	n/a*	8/14	8/31
4	Guthion 50WP	PF-7C	0.5 lb	5/23	6/7	6/16	7/6	7/20	8/1	8/14	8/31
5	Guthion 50WP	PF, 1C	0.5 lb	5/23	6/7						
	Calypso 4F	2C	1.5 oz			6/16					
	Spintor 2SC	3,4C	1.5 oz				7/6	7/20			
	Assail 70WP	5,6,7C	0.5 oz						8/1	8/14	8/31
6	Calypso 4F	PF,1,2C	1.5 oz	5/23	6/7	6/16					
	Spintor 2SC	3,4C	1.5 oz				7/6	7/20			
	Assail 70WP	5,6,7C	0.5 oz						8/1	8/14	8/31
7	Avaunt 30WDG	PF	0.7 oz	5/23							
	Intrepid 2F	PF	1.0 oz	5/23							
	Calypso 4F	1,2C	1.5 oz		6/7	6/16					
	Rimon EC	3,4C	7.0 oz				7/6	7/20			
	Assail 70WP	5,6,7C	0.5 oz						8/1	8/14	8/31
8	Rimon EC	PF,1,3,4C	7.0 oz	5/23	6/7		7/6	7/20			
	Actara 25W	2C	1.5 oz			6/16					
	Calypso 4F	5C	1.5 oz						n/a*		
	Assail 70WP	6,7C	0.5 oz							8/14	8/31
9	Untreated Check										

*n/a – sprays were missed due to equipment problems

a deep tunnel or surface sting. Data were subjected to an AOV, and means were separated with Fisher's Protected LSD Test ($P<0.05$). Data was transformed arcsine (Sqrt x) prior to analysis.

All treatments reduced damage (Table 2) from that found in the untreated check (25.5%). The two programs containing Rimon 0.83 EC seemed to control damage most effectively. The first treatment had four applications (PF, 1C, 3C, 4C) and yielded 4.0% damage, while the second treatment only had two (3C, 4C) and had 6.5% damage, indicating that the petal fall and 1st cover sprays had a slight but non-significant effect on damage found at harvest. The 2nd treatment had Avaunt 30WDG and Intrepid 2F applied at petal fall and Calypso 4F applied at first cover. Given the small difference, both of these treatments would give acceptable levels of control in such a high-pressure situation. Both of these treatments also gave better efficacy than full season programs of Guthion 50WP (8.0%) and Calypso 4F (8.25%).

However, these data indicate that Calypso is comparable in efficacy to the standard organophosphate and could serve as a replacement in the future. A full-season program of Assail 70WP was also included in this trial at a less than optimal rate (0.5 oz/100) and, although it did show a significant difference from the untreated plot, previous trials indicate much better results when used at a higher

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rate. The two treatments including Spintor 2SC at the 3rd and 4th cover timings did not control internal worms very well. Due to the fact that this is traditionally when the 2nd generation is best controlled, and that the materials applied to these treatments before the emergence of the 2nd generation are known to provide adequate efficacy, it can be assumed that Spintor did not control the intended targets and that the majority of the damage was caused by the 2nd generation of internal leps.

The only synthetic pyrethroid included in this trial was Warrior 1CS. This material was applied on a full-season program and, due to the lack of control seen in these plots, raises some questions regarding the previous heavy use of other pyrethroids on this farm, indicating the possibility of resistance to this class of chemistry.❖❖

TABLE 2.
Percent damage caused by internal Lepidoptera complex, Wayne Co., 2006

			Damage at Harvest		
Trt	Material	1st Gen	Tunnels	Stings	Total Damage
1	Assail 70WP	6.3 a	4.5 bc	6.0 b	10.5bc
2	Calypso 4F	4.8 a	3.3 abc	5.0 b	8.3 b
3	Warrior 1CS	8.0 ab	6.5 c	8.3 b	14.8 c
4	Guthion 50WP	3.5 a	1.0 a	7.0 b	8.0 b
5	Guthion 50WP Calypso 4F Spintor 2SC Assail 70WP	4.8 a	6.0 c	5.3 b	11.3 bc
6	Calypso 4F Spintor 2SC Assail 70WP	2.5 a	5.0 bc	5.8 b	10.8 bc
7	Avaunt 30WDG Intrepid 2F Calypso 4F Rimon EC Assail 70WP	9.0 ab	2.0 abc	4.5 ab	6.5 ab
8	Rimon EC Actara 25W Calypso 4F Assail 70WP	4.5 a	1.8 ab	2.3 a	4.0 a
9	Untreated Check	16.3 b	18.8 d	6.8 b	25.5 d

Means within a column followed by the same letter are not significantly different (Fisher's Protected LSD Test, P≤0.05). Data transformed (arcsine-square root) prior to analysis.

DISEASES

KICK 'EM WHEN THEY'RE DOWN

APPLE SCAB AND POST-INFECTION FUNGICIDES (PART III)
(Wolfram Koeller, Plant Pathology, Geneva)

❖❖ As described in Part II, the majority of orchards we tested has reached the stage of resistance to the first SIs, Nova, Procure and Rubigan. Although the selection of the orchards was biased, we must assume that SI resistance is more widespread than we would wish. Several orchards, where SIs had been used four times per season for 20 years, had even surpassed the level of resistance we know to cause commercially unacceptable levels of fruit scab at harvest.

Why has this development escaped our full attention? Most likely, because the SIs were routinely used in mixture with the low 3 lb/acre rate of an EBDC fungicide such as Dithane. In mild scab seasons, in particular on cultivars less susceptible than McIntosh, the low-rate of EBDC was sufficient to control scab on its own. But as we know today, this mixture strategy did not halt the development of SI resistance, and while resistance was building up, the EBDC in the mixture became more and more important for the overall control of scab.

This development remained unnoticed over several seasons, until complete control failures were encountered during an unusually severe scab year, where the EBDC alone failed to control scab. As already mentioned in Part II, we can only provide crude guidance to this problem without testing the sensitivities of the orchard under question. This guidance relates to the total SI applications made over the years. In all cases we examined, the SIs lost their originally excellent 'kick-back' activity after they had been applied around 60 times in total, even in mixture with an EBDC. Apparently, this total number could be spread over 15 years with four applications per season, or theoretically over 30 years with only two applications per season. As also mentioned in Part II, this history of total SI applications made over many years is not known for many of the currently productive orchards.

What are the current 'kick-back' alternatives to the SIs? Two new classes with post-infection activities were introduced in 2000, the strobilurins (Flint, Sovran) and the AP fungicides (Scala and Vangard).

We started to evaluate the risk of **resistance to strobilurin** long before the fungicides were introduced. Our overall conclusion was: Resistance to Flint and Sovran will develop quite rapidly. Initially, we will experience a gradual increase of scab strains that will still respond to the fungicides, but only at higher application rates. After that, totally immune strains will take over an orchard, and increasing the application rates or shortening the spray intervals will not provide any scab control. This type of immunity was first encountered for the class of benzimidazole fungicides (Benlate and Topsin M), with resistance lingering on in the majority of orchards after 15 years of discontinuing their use in scab management.

In cooperation with colleagues in Germany, where the strobilurin fungicides were introduced earlier than in the US, we found that as few as 15 applications in total had selected immune strains to a level causing control failures. Fortunately, we have yet not found such totally immune strains in our tests of US orchard sensitivities. However, we found that in many orchards in New York, strains of the scab fungus have become less sensitive to a strobilurin fungicide. The results are described in Table 1 for the same 77 commercial orchards also tested for their level of SI resistance (Part II).

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Table 1. Status of strobilurin sensitivities in 77 orchards tested from 2003-2006.

Year	Baseline	Shifted
2003	0	4
2004	2	15
2005	6	14
2006	16	20
Total	24	53

Can we relate the total numbers of strobilurin applications since 2000 to the levels of the sensitivity shifts we measured? The current answer is no. We found shifts in orchards, where strobilurin fungicides were applied only twice, but some orchards remained baseline-sensitive after up to 16 applications in total. At this point, we cannot explain this discrepancy. Theories exist, but they have very limited value in predicting the expected scab performance of the strobilurins under real-world conditions.

The impact of sensitivity shifts on scab control was tested in one of our Geneva test orchards with a sensitivity shift typical for the majority of commercial orchards we have tested (Table 1). Treatments were designed to examine the 'kick-back' activity of the strobilurins in comparison to the purely protective fungicide Dithane at the low 3 lbs/acre rate, either alone or in mixture with Captan 80WDG at 2.5 lbs/acre. Three of the four treatments at tight cluster, pink, petal fall and first cover were applied 48–72 hours after the start of an infection period. The bloom spray was a protective spray with Dithane in order to follow the label restriction of no more than two consecutive treatments. The results are summarized in Table 2.

Table 2. Fungicide performances at harvest in a McIntosh test orchard with shifted sensitivities to strobilurin fungicides in 2006.

Treatments	Fruit scab (%)	Leaf scab (%)
Check	86	73
Dithane	54	24
Captan + Dithane	37	12
Flint	27	14
Dithane, then Flint	37	16
Scala, then Flint	31	11

The results confirmed our experiences during several test seasons. Under shifted orchard conditions, Flint and Sovran performances were superior to the low rate of Dithane applied at the same post-infection schedule, but they were not superior to the mixture of Dithane with Captan.

Our overall conclusion is that in orchards with increased proportions of more tolerant scab strains, the strobilurins will maintain their excellent protective activities, while their 'kick-back' activities erode. Without knowledge of the orchard-specific sensitivity, Flint and Sovran should not be used in a deliberate 'kick-back' mode but rather as a protective fungicide on a more or less 7-day spray schedule.

The AP class of fungicides (Scala and Vangard) was also introduced in 2000. These fungicides undoubtedly provide good 48-hr 'kick-back' activity during pre-bloom applications, but the question of how to beneficially incorporate this activity into scab management programs remains unresolved. We have shown that some strains of the scab fungus resistant to SIs are also less sensitive to the APs before these fungicides were ever applied. This interdependence between SI and AP sensitivities was fully confirmed during our sensitivity tests in 2006, where we modified our sensitivity test procedure in order to better reflect the sensitivity shifts we had observed previously. In these 2006 tests, the

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AP sensitivities of only 7 out of 36 orchards were baseline-sensitive. Of these 36 orchards tested, 31 were also resistant to the SIs.

Our SI-resistant test orchard at Geneva reflects the sensitivity shifts to AP fungicides we observed with the majority of other orchards resistant to SIs. The problem we encountered in our test orchard during several seasons of performance testing was that the post-infection advantages of APs in pre-bloom applications was not reflected in improved fruit scab control at harvest. One example of performance tests in 2006 is included in Table 2. Although the immediate effect of two 'kick-back' applications of Scala at tight cluster and pink were far superior to the Captan/Dithane mixture applied at the same 48–72-h post-infection schedules, this advantage had eroded for scab recorded at harvest. Our current recommendation is to apply Scala or Vangard at their **highest label** rates and **in mixture** with a low rate of an EBDC whenever they are used in an SI-resistant orchards.

A second question we have addressed over many years is, whether **dodine** can be reintroduced. Dodine was the first post-infection fungicide introduced in the early 1960s, originally as Cyprex and currently marketed as Syllit, with resistance emerging in the early 1970s. During extensive sensitivity tests in the early 1990s, we found a pattern of resistance development very similar to the SIs. The threshold of resistance was reached after approximately 60 applications in total. These applications could be spread over 10 years with six applications per seasons, or over 30 years with two applications per season.

Our test results from 2003–2006 suggest that **dodine** could be of renewed value in some orchards. We found that only 34% of these orchards were fully resistant to dodine, while 29% were baseline-sensitive. The results are summarized in Table 3.

Table 3. Status of dodine resistance in 77 commercial orchards tested from 2003-2006.

Year	Baseline	Shifted	Resistant
2003	0	2	2
2004	8	4	5
2005	4	9	7
2006	10	14	12
Total	22	29	26

Can we recommend the cautious use of dodine as a fungicide when kick-back activity is needed? The answer is a resounding no. We found that resistance to dodine is very stable once it was established in the past, even after the fungicide had not been used for over 20 years, and even in replanted orchard blocks surrounded by dodine-resistant orchards. The history of dodine resistance, which started to become a problem 30 years ago, is rarely known for the orchards we tested. Without precise knowledge of orchard sensitivities, which can be tested, **the use of Syllit remains very risky**.

Where do we stand, and what scab fungicides should we use?

- The **strobilurins** Flint and Sovran have never fully matched the originally excellent 96-hr 'kick-back' of the SIs, and initial shifts in orchard sensitivities have further eroded their 'kick-back' activities, but their protective activity remains superior or at least equal to the older protective fungicides at their high label rates. In most orchards, two applications at petal fall and 1st cover will provide good protection of developing fruits, combined with control of powdery mildew.

- The **APs** Scala and Vangard are known to be poor protective fungicides, and they are only recommended for applications up to bloom. Here, they retain their 'kick-back' activity, but in our SI-resistant test orchard, this advantage had little or no impact on fruit scab at harvest. This restriction must be kept in mind in orchards treated with an AP early in the season. Good protection at petal

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fall and 1st cover will be a must, even in orchards that appear to be 'clean'.

Where do we go? In the future, scab management will have to rely on all of our fungicide options. However, the decision as to which fungicides to use will depend on the orchard-specific level of resistance to these options. For the past four years, we have designed sensitivity tests that allow orchard-specific sensitivity testing of all fungicides with post-infection potential. This service will be provided again in 2007. Details are described in the accompanying article in this Scaffolds issue. ❖❖

WANT SMOR?

SITE-SPECIFC MANAGEMENT OF FUNGICIDE RESISTANCE (SMOR)

(Wolfram Koeller and Diana Parker, Plant Pathology, Geneva)

❖❖ Over the past four years, we have developed and implemented a test service that allows us to measure the orchard-specific level of resistance to SIs, the strobilurins, the APs and dodine. Financial support for the development of this test service was provided by the Northeast IPM Program.

The financial support will allow us to test 20 orchards in 2007, for the last time without charge. Our emphasis will be on orchards with scab symptoms on leaves after the primary scab program has been completed with the 1st cover application. However, we also will test samples taken from non-treated 'corner' trees or trees in the immediate vicinity to the orchard. We will not accept samples taken after 30 June. Our test will fail with leaves older than that.

The 20 orchards we will test without charge will be selected on a 'first come first served' basis. The submission form and the collection and shipment procedure can be obtained from our Tree Fruit and Berry pathology site (http://www.nysaes.cornell.edu/pp/extension/tfabp/index.html) under 'SMOR-New!', or from your regional Cornell Cooperative Extension agent.

Please review the collection and shipment procedures located on our Geneva web site (http://www.nysaes.cornell.edu/pp/extension/tfabp/index.html) or from your regional Cornell Cooperative Extension agents. No shipment of leaves will be accepted without a completed submission form.

Contact Diana Parker, Cornell University, Department of Plant Pathology, 630 West North Street, Barton Laboratory, New York State Agricultural Experiment Station, Geneva, NY 14456 (Telephone 315-787-2400; dmp2@nysaes.cornell.edu) with any questions or prior to shipment of leaves. ❖❖

PEST FOCUS

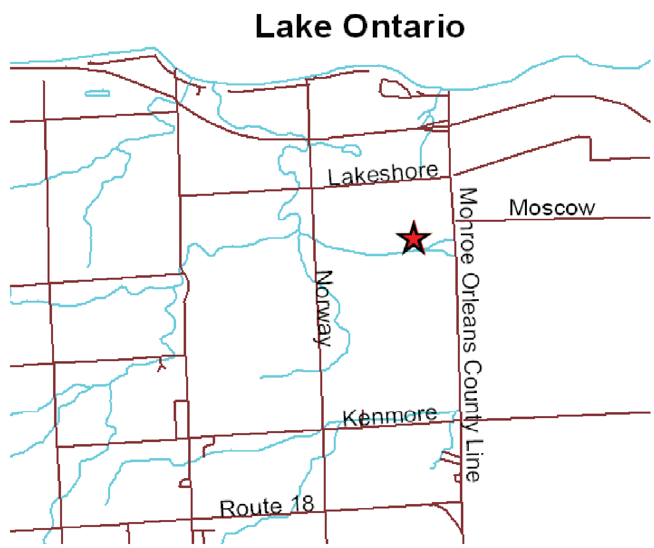
Highland:
Pear psylla nymphs above threshold in apple. **Plum curculio** and **tarnished plant bug** observed in apple and stone fruits. 1st **codling moth** trap catch.

GENERAL INFO

LOCATION, LOCATION, LOCATION

SPRAY DEMO REMINDER
(Andrew Landers, Entomology, Geneva)

❖❖ Just a reminder about the series of extension demonstrations that have been organized about using sensor-controlled precision spray systems with tower orchard sprayers. Growers are encouraged to attend, to view the latest technology at work and to hear about the potential savings in pesticide used. The first workshop will be held at 2:00 pm on May 17, at Mike Zingler's farm in Monroe Co., on Monroe-Orleans County Line Rd (between Kenmore and Lakeshore Rds.) ❖❖



PHENOLOGIES

Geneva:

	5/14	5/21 (Predicted)
Apple(McIntosh):	bloom	petal fall
Apple(Red Delicious):	king bloom	bloom – petal fall
Pear:	bloom	petal fall – fruit set
Sweet cherry:	petal fall	fruit set
Tart cherry:	50% petal fall	petal fall – fruit set
Peach:	petal fall	shuck split

INSECT TRAP CATCHES
(Number/Trap/Day)

Geneva, NY

	5/7	5/10	5/14
Green fruitworm	0.0	0.0	0.0
Redbanded leafroller	3.0	13.2	2.8
Spotted tentiform leafminer	1.1*	16.7	6.4
Oriental fruit moth	0.1*	3.2	0.6
Codling moth	–	–	0.0
Lesser appleworm	–	–	0.0
American plum borer	–	0.0	0.0

Highland, NY

	5/7	5/14
Green fruitworm	0.0	0.0
Redbanded leafroller	–	–
Spotted tentiform leafminer	28.6	42.5
Oriental fruit moth	6.2	9.8
Codling moth	0.0	0.1*

* first catch

UPCOMING PEST EVENTS

	43°F	50°F
Current DD accumulations (Geneva 1/1–5/14/07):	384	192
(Geneva 1/1–5/14/2006):	469	223
(Geneva "Normal"):	441	241
(Geneva 1/1–5/21/2007, Predicted):	476	243
(Highland 3/1–5/14/07):	348	187

Coming Events:	Ranges(Normal±StDev):	
McIntosh at petal fall	418–563	228–282
Red Delicious at bloom	384–586	192–240
Green fruitworm flight subsides	170–544	101–239
American plum borer 1st catch	194–567	141–279
Spotted tentiform leafminer 1st flight peak	180–544	114–208
Oriental fruit moth first flight peak	259–700	159–285
Pear psylla first egg hatch	111–402	60–166
Redbanded leafroller 1st flight peak	180–455	101–191
Rose leafhopper nymphs on multiflora rose	188–402	96–198
Codling moth 1st catch	273–805	191–337
Lesser appleworm 1st catch	135–687	112–302
Mullein bug 1st hatch	319–514	163–239
Mullein bug 50% hatch	363–589	203–281
Plum curculio oviposition scars present	450–606	256–310
San Jose scale 1st catch	189–704	188–326
Spotted tentiform leafminer sap-feeders present	295–628	165–317

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